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(54) Abstract Title
Regulated drawing system for fibre material

(57) In a regulated drawing system 2 for fibre material having a controllable or regulatable drive system 26 for determining the degree of drafting in the mentioned drafting zone 13/II; 11, 12/I, a programmable control system for the drive system and at least one sensor 9 for ascertaining the throughput fibre mass per unit of length, a draft-determining signal is stored in a memory of the control system over a predetermined period and information for adapting the drawing system is obtained from the stored values. The information includes a spectrogram of at least one fibre structure 5;18, the shape (form, content) of which spectrogram is evaluated and used to adapt the drawing system.

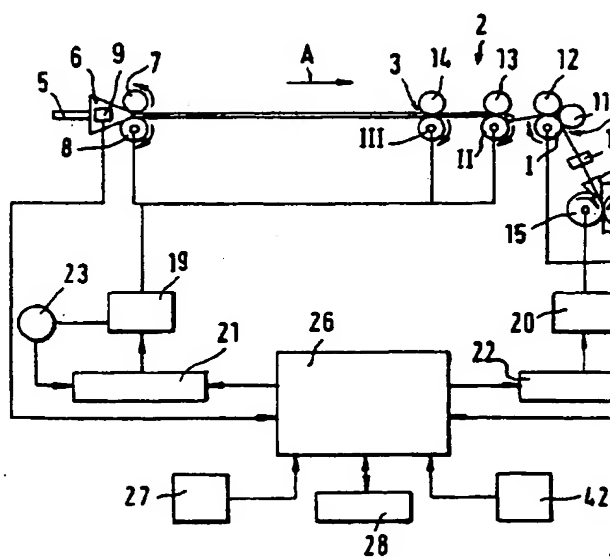


FIG.1

GB 2 326 888 A

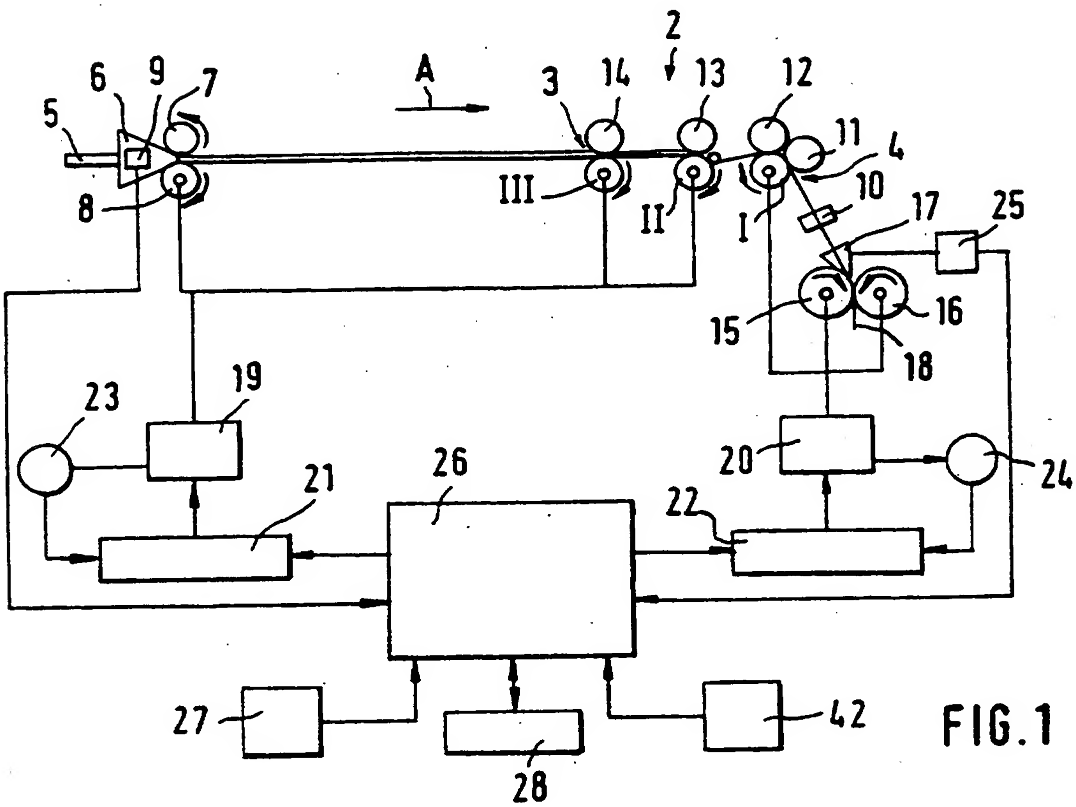

2
A
3
14
13
12
11
4
10
17
25
6
9
7
5
8
III
II
I
15
16
18
19
23
21
26
20
22
24
27
28
42

FIG.1

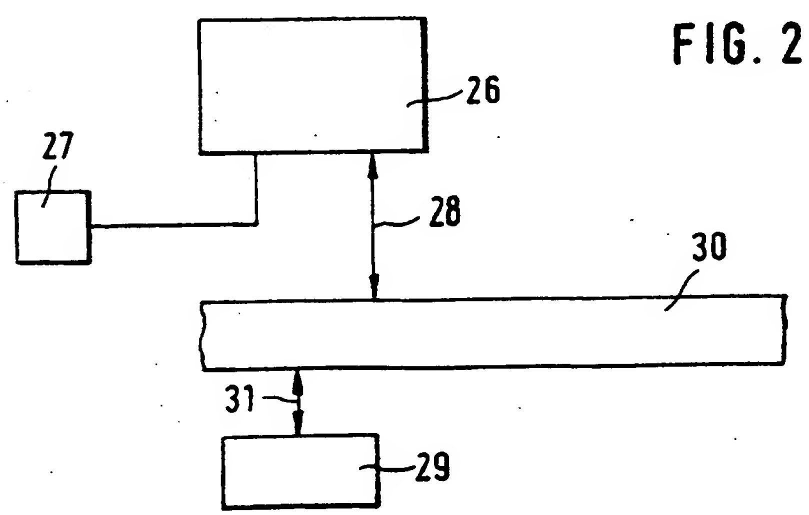

26
27
28
30
31
29

FIG. 2

Fig. 3

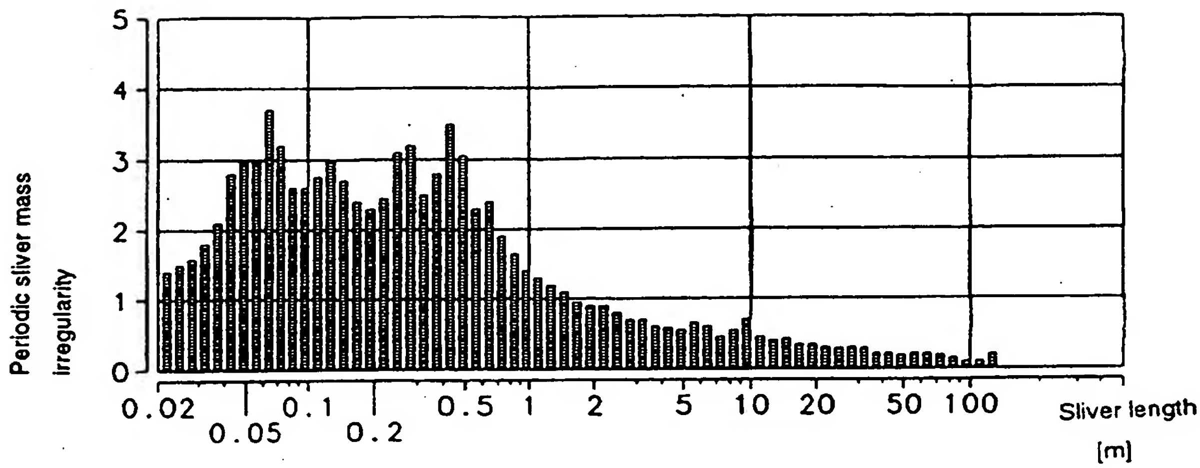

Periodic sliver mass irregularity
5
4
3
2
1
0
0.02
0.05
0.1
0.2
0.5
1
2
5
10
20
50
100
Sliver length [m]

Fig. 4

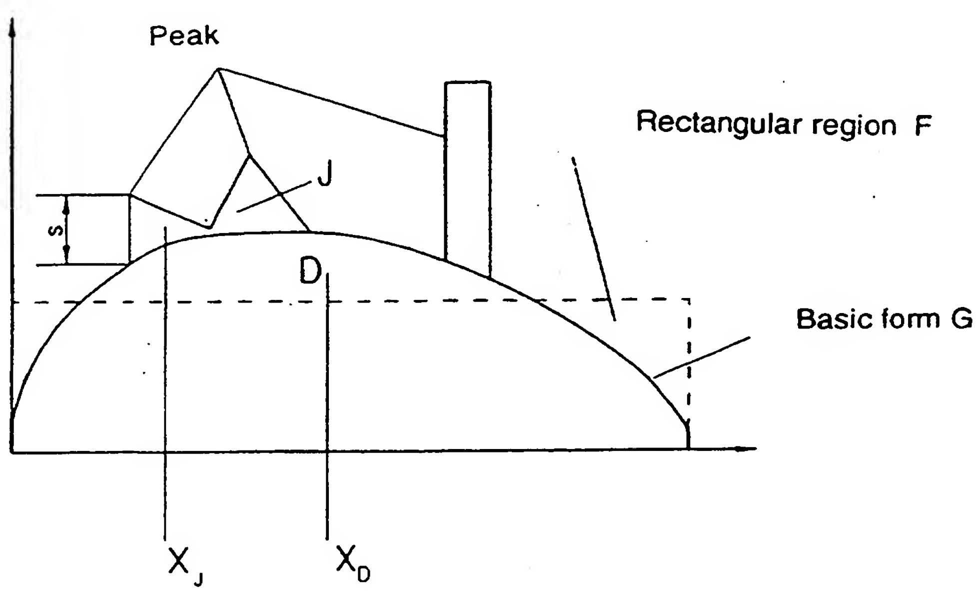

Peak
J
s
D
Rectangular region F
Basic form G
X_J
X_D

FIG. 5

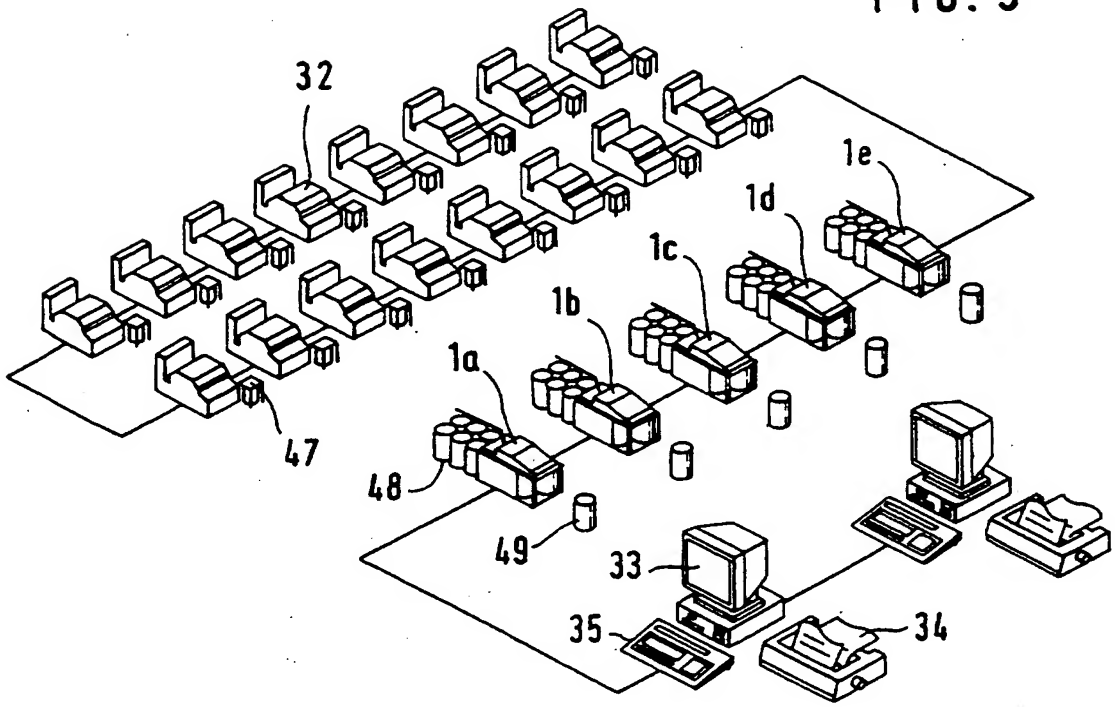
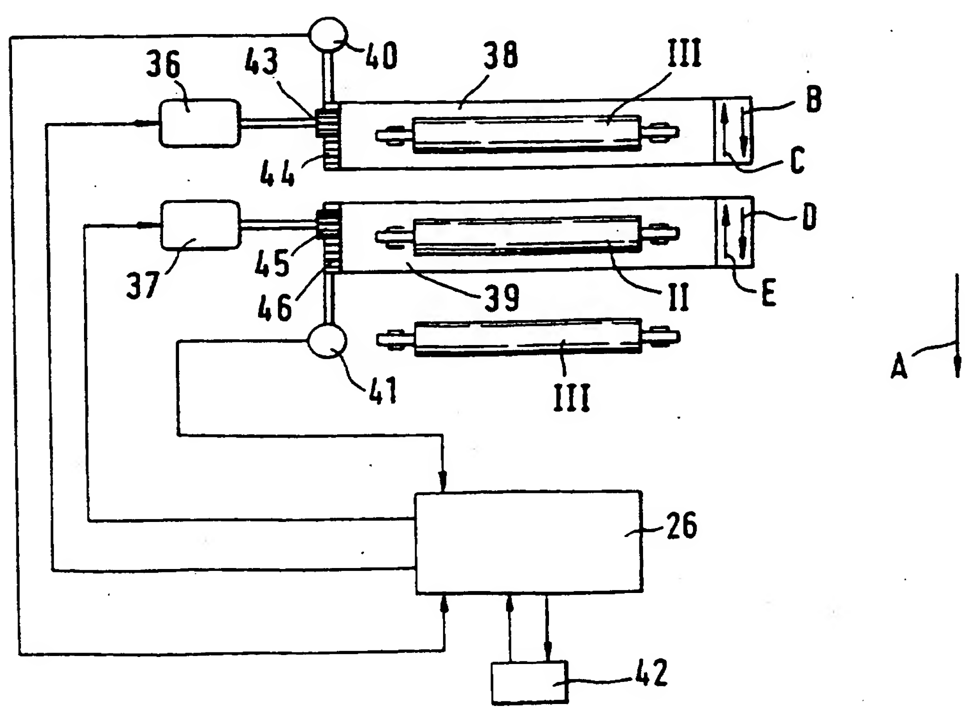

32
1e
1d
1c
1b
1a
47
48
49
33
35
34

FIG.6


36
43
40
38
III
B
C
44
D
45
37
46
39
II
E
41
III
A
26
42

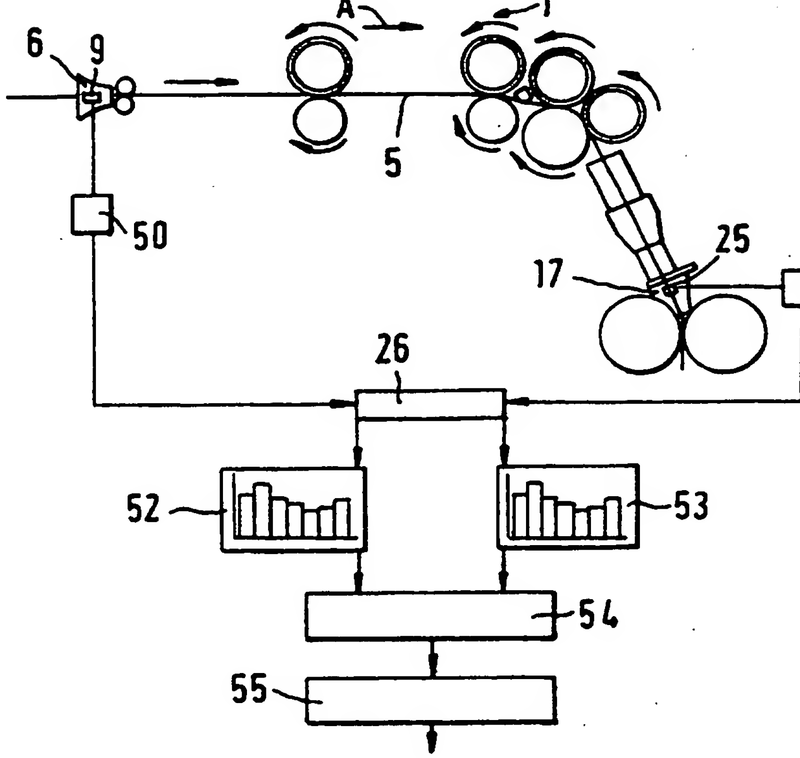

A
1
6
9
5
50
25
17
51
26
52
53
54
55

FIG. 7

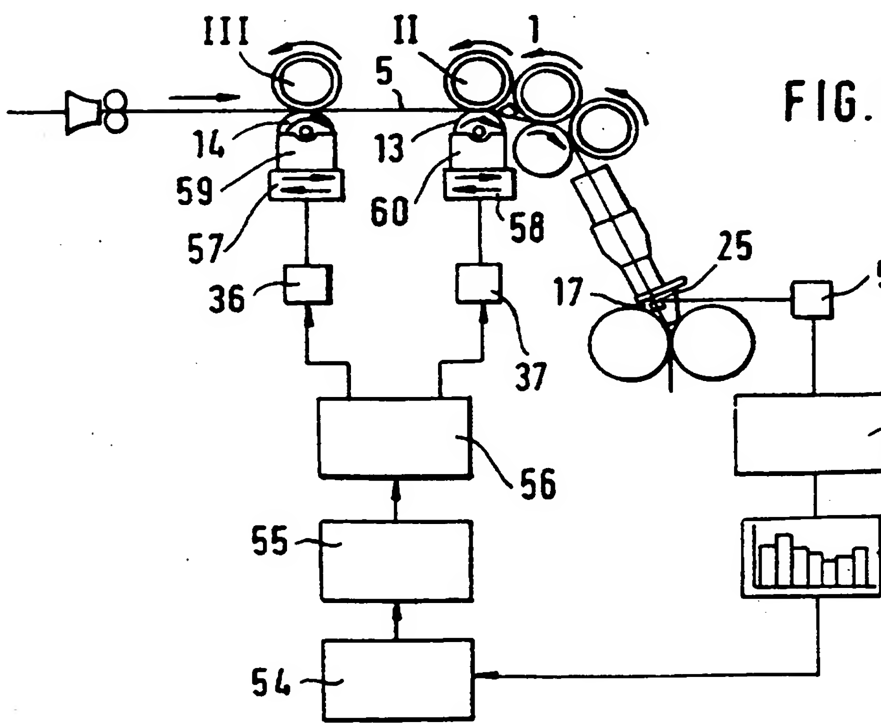

III
II
5
1
14
13
59
60
58
57
36
37
25
17
51
56
26
55
53
54

FIG. 8

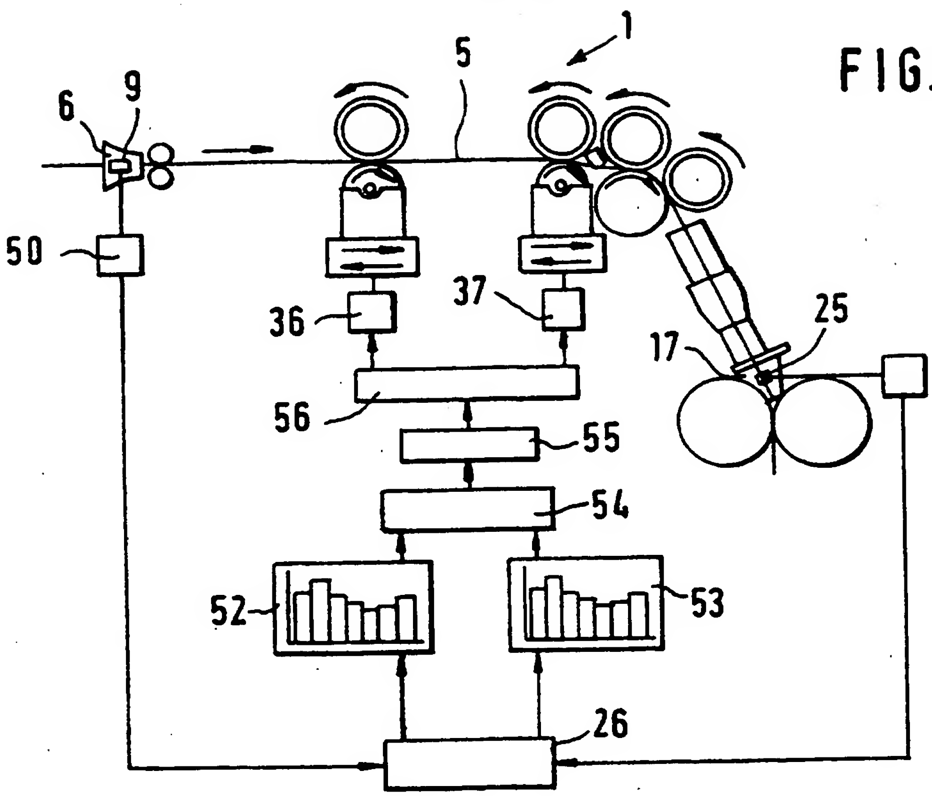


FIG.9

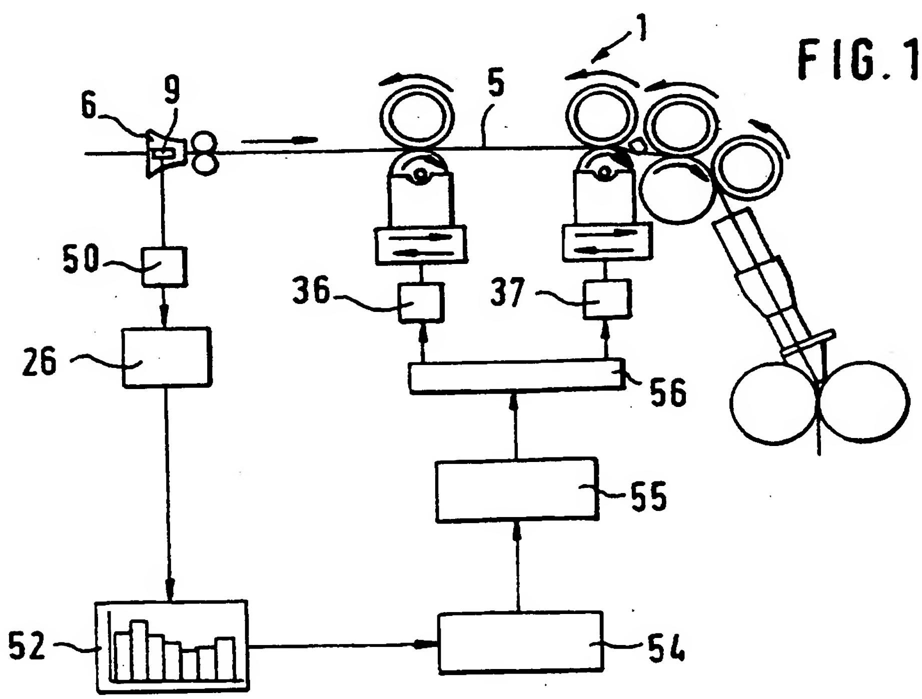


FIG.10

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Regulated drawing system for fibre material

The invention relates to a regulated drawing system for fibre material.

In a known regulated drawing system, information is obtained for adapting the drawing system and/or for assessing the quality of the feed fibre material. The information is said to include, for example, the CV value of the feed fibre sliver combination, the spectrogram of the feed fibre sliver combination and/or the length variation curve of the feed fibre sliver combination. The draft-determining signal may be an output signal of a sensor or a control signal for the drive system. It is a disadvantage that the adaptation of the drawing system is limited to the regulation of the main drafting operation, that is to say to a speed regulation of the drive motors for the rollers of the drawing system. Moreover, it is troublesome that the information is to be obtained only from data relating to the feed fibre sliver combination. Obtaining the information requires complex equipment. Finally, adaptation is provided only for a specific processed material.

It is an aim of the invention to provide a regulated drawing system that avoids or mitigates the mentioned disadvantages and especially enables there to be obtained a substantially improved adaptation of a draw frame to every change in material and/or when there are changes in the quality of the fibre formation(s) produced.

The invention provides a method of regulating a drawing system having at least one drafting zone, comprising ascertaining at a measuring location in the

drawing system a variable relating to at least one travelling fibre structure, generating therefrom a spectrogram of said at least one fibre sliver structure evaluating the spectrogram and adjusting the drawing system in dependence on that evaluation.

The invention further provides a regulated drawing system for fibre material having at least one drafting zone, and at least one sensor for ascertaining at a measuring location a variable relating to at least one travelling fibre structure, the regulated drawing system comprising means for generation of a spectrogram of at least one fibre structure, the shape (form, content) of which spectrogram can be evaluated, and means for adjusting the drawing system in dependence on the results obtained in said evaluation.

Furthermore, the invention provides a regulated drawing system for fibre material having at least one drafting zone, a controllable or regulatable drive system for determining the degree of drafting in the said drafting zone, a programmable control system for the drive system and at least one sensor for ascertaining at a measuring point the throughput fibre mass per unit of length passing through, in which system, a draft-determining signal is stored in a memory of the control system over a predetermined period and information for adjusting the drawing system is obtained from the stored values, wherein the information includes a spectrogram of at least one fibre structure, the shape (form, content) of which spectrogram is evaluated and used to adjust the drawing system.

The adaptation (adjustment) of the drawing system is substantially improved as a result of the measures

according to the invention. From the analysis of the spectrogram, its structure in terms of its form and content, undesirable deviations from desired values, for example machine-related and/or fibre technology values, are detected in a simple manner for every change in material and/or when there are changes in the quality of the fibre structure produced. The type and extent of the deviation is ascertained. Advantageously, in the simplest case it is already possible by means of an optical analysis of the spectrogram on a screen to detect undesirable deviations during operation, which can be used by operating personnel to adapt the drawing system, for example, by altering the nip line spacings and/or the drafts. The invention also enables a computer evaluation of the spectrogram and a corresponding adaptation of the drawing system on the basis of the evaluation results, either by operating personnel or automatically by the computer in conjunction with the regulated drawing system.

The fibre structure, of which the spectrogram is used, may be the drawn fibre material at the outlet of the drawing system. The fibre structure, of which the spectrogram is used, may be the feed fibre material at the inlet of the drawing system. Preferably, the variable that is ascertained is the fibre mass per unit length. Advantageously, the form of the spectrogram is evaluated. Preferably, the content of the spectrogram is evaluated. Advantageously, the evaluation comprises a weighting. Preferably, the basic form curve (envelope curve) of the spectrogram is evaluated. Advantageously, there are determined the area below the basic form curve (G), a rectangular region (F), the area of which is the same as the area of the basic form region, the area of the basic

form region (D) that projects beyond the rectangular region and the position (X_D) of the centre of gravity of the area of the projecting basic form region. Preferably, the individual forms projecting beyond the basic form curve are evaluated. Advantageously, instances where the limit value of the spectrogram is exceeded are evaluated. Preferably, envelope curves are determined for the individual forms projecting beyond the basic form curve. Advantageously, for each envelope curve there is determined the distance (S) between the upper reversal point and the basic form curve (G), the area (I) below each envelope curve and the position (X_I) of the centre of gravity of the area (I) below each envelope curve. Preferably, to adapt the drawing system there are used the region size (F), the projecting basic form region (D), the distance (S) and/or the areas (I). Advantageously, an evaluation is carried out for form and content by zones. Preferably, an evaluation of part areas and/or part forms is carried out. Advantageously, an evaluation of the position of the part areas and part forms is carried out. Preferably, an evaluation of the positions of the centre of gravity of the part areas and part forms is carried out. Advantageously, the nip line spacings of the pairs of rollers that delimit the drafting zones can be adjusted for adaptation of the drawing system. Preferably, the drawing system can be adapted when a switch is made to a new material (fibre material). Advantageously, the degrees of drafting of the drafting zones of the drawing system can be adjusted. Preferably, the total degree of drafting can be adjusted. Advantageously, optimum nip line spacings can be set automatically, for example after every change of material. Preferably, a computer, for example a microcomputer having a microprocessor, is present, which is

used to evaluate the spectrogram and to adapt the drawing system. Advantageously, the fibre mass can be detected on-line at the measuring point. Preferably, on-line spectrogram determination is carried out. Advantageously, the spectrogram is reproduced on a display, for example a screen, print-out. Preferably, a spectral analysis is carried out on-line. Advantageously, the regulated drawing system is a draw frame. The regulated drawing system may be associated with the outlet of a carding machine. Advantageously, the regulated drawing system is arranged between the sliver funnel of the carding machine and the rotating head of the can coiler. Preferably, the fibre bundle is a feed sliver. Advantageously, the regulated drawing system is arranged downstream of at least one upstream drawing system.

Certain illustrative embodiments of the invention will now be described with reference to the drawings, in which:

Fig. 1 is a schematic diagram of a regulated drawing system according to the invention comprising a computer unit;

Fig. 2 is a schematic diagram showing the connection of the computer unit to a process control computer;

Fig. 3 is a spectrogram of a draw frame sliver;

Fig. 4 is a graph showing forms and areas of a spectrogram, which are used for the evaluation;

Fig. 5 is a perspective view of a textile installation having a Sliver Information System KIT in a network comprising carding machines and draw frames;

Fig. 6 is a schematic view of a part of the drawing system showing the computer-controlled, motor-driven adjustment of the nip line spacings in the regulated drawing system;

Fig. 7 is a schematic side view of a regulated draw frame together with a block diagram for the production and evaluation of spectrograms for the incoming fibre material (slivers or sliver combination) and for the outgoing fibre material (sliver) for the manual adjustment of the drawing system;

Fig. 8 is a schematic side view of a part of a regulated draw frame together with a block diagram for the formation and evaluation of a spectrogram for the outgoing fibre material for the automatic adjustment of the drawing system;

Fig. 9 is a schematic side view of a part of a regulated draw frame together with a block diagram for the automatic adjustment of the drawing system; and

Fig. 10 is a schematic side view of a part of a regulated draw frame together with a block diagram for the formation and evaluation of a spectrogram for the incoming fibre material for the automatic adjustment of the drawing system.

With reference to Fig. 1, a draw frame 1, for example a draw frame of the type made by Trützschler GmbH & Co. KG and known as an HSR draw frame, has a drawing system 2, upstream of which there is arranged a drawing system intake 3 and downstream of which there is arranged a drawing system outlet 4. The slivers 5, coming from cans (see Fig. 5, position 48), enter the sliver guide 6 and, drawn by the delivery rollers 7, 8, are conveyed past the measuring element 9. The drawing system 2 is configured as a 4-over-3 drawing system, that is to say it consists of three lower rollers I, II, III (I outlet lower roller, II middle lower roller, III inlet lower roller) and four upper rollers 11, 12, 13, 14. The drafting of the fibre structure 5 consisting of a plurality of slivers is effected in the drawing system 8. The drafting is composed of preliminary drafting and main drafting. The pairs of rollers 14/III and 13/II form the preliminary drafting zone, and the pairs of rollers 13/II and 11, 12/I form the main drafting zone. The drawn slivers 5 arrive at a web guide 10 in the drawing system outlet 4 and are drawn, by means of delivery rollers 15, 16, through a sliver funnel 17, in which they are combined to form a sliver 18, which is then deposited into cans (see Fig. 5, position 49).

The delivery rollers 7, 8, the inlet lower roller III and the middle lower roller II, which are coupled mechanically, for example by way of toothed belts, are driven by the regulating motor 19, it being possible to preset a desired value. (The associated upper rollers 14 and 13, respectively, rotate therewith). The outlet lower roller I and the delivery rollers 15, 16 are driven by the main motor 20. The regulating motor 19 and the main motor 20 each have their own regulator 21 and 22, respectively.

The regulation (speed regulation) is effected in each case by way of a closed control circuit, a tachogenerator 23 being associated with the regulator 19 and a tachogenerator 24 being associated with the main motor 20. At the drawing system intake 3, a value proportional to the mass, for example the cross-section of the incoming slivers 5, is measured by an intake measuring element 9, which is known, for example, from DE-A- 44 04 326 (corresponding to GB 2 277 106A). At the drawing system outlet 4, the cross-section of the outgoing sliver 18 is obtained by an outlet measuring element 25, known, for example, from DE-A- 195 37 983 (corresponding to GB 2 306 222), which is associated with the sliver funnel 17.

A central computer unit 26 (control and regulating unit), for example a microcomputer having a microprocessor, transmits an adjustment of the desired value for the regulating motor 19 to the regulator 21. The measurements from the two measuring elements 9 and 25 are transmitted to the central computer unit 26 during the drawing operation. The desired value for the regulating motor 19 is determined in the central computer unit 26 from the measurements from the intake measuring element 9 and from the desired value for the cross-section of the outgoing sliver 18. The measurements from the outlet measuring element 25 are used to monitor the outgoing sliver 18 (output sliver monitoring). Using that regulating system, it is possible to compensate for variations in the cross-section of the slivers 5 that are fed in by appropriate regulation of the drafting operation and/or to render the sliver 18 uniform.

Associated with the central computer unit 26 of the machine is a memory 27, where the, or certain, signals from the drawing system control or regulating system are stored

for the evaluation. If the operating speed of the microprocessor in the computer unit 26 is high enough, a sufficiently high scanning rate can be selected for a spectrogram to be obtained of the output signal (from sensor 25) and/or of the input signal (from sensor 9). The evaluation of the values contained in the memory 27 can be effected as a function of time. In the case of a spectral analysis, the time functions are then converted into frequency functions according to the Fast-Fourier-Transform method. The time required to do so depends upon the computing speed of the processor and the number of frequencies (or frequency ranges) to be studied individually. For an adequate analysis of a feed material, preferably at least 1024 individual frequency ranges are to be studied.

Such an evaluation requires considerable computing and/or memory capacity in the machine itself. In many cases this may not be present, with the result that the analysis must be transferred to a process control computer 29. A data bus 30 can be provided for that purpose, and the control system 20 can be provided with an interface 28 to that data bus, the computer 29 also having an interface 31 to the data bus.

Fig. 3 is a spectrogram for a draw frame sliver 18, which was obtained using a sliver monitoring device of the type known as the Trützschler Sliver Information System KIT, manufactured by Trützschler GmbH & Co. KG (Fig. 5). The sliver length is plotted along the abscissa in metres and the periodic sliver mass irregularity (dimensionless) is plotted along the ordinate. The spectrogram constitutes a complex structure, from which numerical and weighted results are derived, for which purpose the type of

spectrogram evaluation according to the invention is provided. Preferably, the spectrograms produced on-line by way of the outlet funnel 17 in the form of a measuring element 25 are used for the evaluation, since influences arising from storage in cans, storage duration and storage conditions thus have no effect. Advantageously, the spectrograms for the evaluation are produced using absolute values from the thickness measurement.

According to Fig. 4, the spectrogram is studied and evaluated numerically in accordance with basically two criteria;

a) the basic form of the spectrogram;
b) the individual peaks projecting beyond the basic form.

in relation to a): the basic form is evaluated according to the 1st area below the basic form curve G. A rectangular region F having the same area is then defined. The projecting basic form region D is determined in size. The position of the centre of gravity of that region D is defined on the x-axis. The values for D constitute the 2nd criterion and the value X_D constitutes the 3rd criterion. It can already be seen from this that the smaller F and D are, the better the results become.

in relation to b): a simple envelope curve is drawn round the projecting peaks and then for each peak the following is defined:

1. Its peak value S above the basic form curve.
2. The area J between the envelope curve and the basic form curve.

3. The position of the centre of gravity XJ of each region J described.

From this it can also be seen that the smaller the peak values S and the areas J are, the better the results will be. Both values do not, however, have the same effect. Those evaluations yield values that are related to the desired yarn results or even to the results in the sheet structure. Those values can be brought into dependence upon machine settings and also upon quality values in the sliver, yarn and/or sheet structure, with the objective of determining good solution fields and establishing the norms. The end result, however, depends also upon the material properties of the material of the incoming slivers 5. Different materials and different slivers 5 in the intake produce different output values. That problem can be reduced by the fact that the slivers 5 are measured in the intake funnel 6 also and by the fact that a spectrogram is produced from the measurement results. That spectrogram can be evaluated in accordance with the above-mentioned criteria. Thus, in that respect, the initial situation of the slivers 5 before the drawing operation is described and rendered evaluatable. That enables differences between inlet and outlet spectrograms to be detected and evaluated. Those differences yield more precise data relating to the effect of the machine adjustment on the quality result in the draw frame sliver. By virtue of the correlation between the adjustment parameters of the machine and the phenomena in the spectrogram, norms are available, with adjustment instructions for obtaining good results rapidly being worked out from that information and from those

correlations. Provided such instructions yield good results, automatic routines can also be run. Motor-driven adjusting elements in the drawing system control the settings in accordance with stored instruction lists in the machine program. According to a further embodiment, an adjusting and testing iteration program can run automatically, which enables the machine and its control system to search for and find the optimum machine settings itself.

With reference to Fig. 5, a plurality of carding machines 32, for example a high performance carding machine of the type made by Trützschler GmbH & Co. KG and known as the DK 803, is provided in the configuration of 16 carding machines 32, downstream of which there are arranged 5 draw frames 1a to 1e. There is shown diagrammatically a KIT network comprising carding machines 32 and draw frames 1a to 1e, for example Trützschler HSR high performance draw frames, in which network the carding machines and draw frames are connected to the SLIVER INFORMATION SYSTEM TRÜTZSCHLER KIT. The thickness of the sliver 18 is measured continuously and on-line by the measuring element 25 in the sliver funnel 17 of the draw frames, from which spectrograms and spectrogram analyses are obtained by KIT, which are represented in the form of graphics or tables and are displayed on a screen 33 or printer 34.

In the embodiment of Fig. 6, the operator can also enter the nip line spacings K_1 and K_2 of the pairs of drafting rollers into the computer 26 by hand by the keyboard 42 and the computer stores them and, in accordance with those stored values, controls the motors 36 and 37 for adjusting those nip line spacings. The motors 36, 37 can be, for example, pulse motors. The positions of the

carriages 38, 39 can be measured by means of analogue or digital measuring elements 40, 41 and can be entered into a read/write memory of the computer 26, which compares those actual values with the entered desired values for the carriage positions, and the motors 36, 37 are then controlled by the computer 26 in such a manner that the desired values and the actual values tally. The optimum nip line spacings K_1 and K_2 depend mainly upon the staple length of the processed fibres and, to that extent, can be preset. Other features, however, such as the bulkiness of the fibres, the sliver unity, etc., also influence the optimum nip line spacings, which can be optimised in that respect by experimentation. That optimisation can be transferred to the computer 26 in that the computer, in accordance with a program that can be entered into it or that is continuously present in it, alters the nip line spacings K_1 and K_2 several times, and, after each re-adjustment, the irregularity of the drawn and doubled sliver 18 is measured by means of the measuring funnel 17, with the signal caused by the measuring funnel 17 and produced in the measurement transducer 28 being stored over a predetermined period and evaluated. After those measurements have been carried out and evaluated and the relevant data has been stored, the computer 26 then calculates the optimum nip line spacings K_1 and K_2 from those data and occasions automatic adjustment. Those nip line spacings K_1 and K_2 can also be displayed continuously on display fields.

43 and 45 denote toothed wheels, and 44 and 46 denote associated toothed racks. A denotes the direction of operation (direction of flow of material).

In the embodiment of Fig. 7, the intake measuring element 9 is connected to the computer unit 26 by way of a measured value transducer 50 and the outlet measuring element 25 is connected to the computer unit 26 by way of a measured value transducer 51, there being arranged downstream of the computer unit 26 two devices 52, 53 for producing a spectrogram for the incoming fibre material 5 and for the outgoing fibre material 18. The devices 52, 53 are connected to an evaluating unit 54, in which two spectrograms produced in the devices 52 and 53, respectively, are evaluated for their shape (form, content). The evaluation results are entered into a device 55 (computer) in which there is stored an information basis for correlations (e.g. shape of spectrograms in relation to machine-related and/or fibre technology parameters), with recommendations for machine and operating parameters being issued by the device 55, for example on a display, screen, printer. On the basis of the recommendations, the machines can be adjusted manually, as explained as a mode of operation in relation to Fig. 6.

In the embodiment of Fig. 8, the outlet measuring element 25 is connected to the computer unit 26 by way of the measurement transducer 51, there being arranged downstream of the computer unit 26 the device for producing a spectrogram for the outgoing fibre bundle 18. The device 53 is connected to the evaluating unit 54, in which spectrogram produced in the device 53 is evaluated according to its shape. The evaluation results are entered into the device 55, from which recommendations for machine and operating parameters are issued to the machine control and regulating device 56 for adjusting the drawing system 2. The machine control and regulating device 56 is

connected to adjusting elements on the regulated draw frame 1, with an adjusting motor 36 operating a displacing device 57 for the horizontal displacement of the roller pair 14/III in the direction of arrows B, C and an adjusting motor 37 operating a displacing device 58 for the horizontal displacement of the roller pair 13/II. The roller 14 is mounted in a press 59 and the roller 13 is mounted in a press 60. In that manner, an automatic adjustment of the drawing system 2 is effected in accordance with the evaluation results of the spectrogram.

The embodiment according to Fig. 9 corresponds substantially to the embodiment according to Fig. 7, there being arranged downstream of the device 55 (computer) according to the embodiment of Fig. 8 the machine control and regulating device 56, to which there are connected the displacing elements 36, 57 and the displacing elements 37, 58 for the automatic adjustment of the roller pairs 14/III and 13/II, respectively. That construction also enables a comparison between the spectrograms produced in the devices 52 and 53.

The embodiment according to Fig. 10 corresponds to the embodiment according to Fig. 9 insofar as, according to Fig. 10, only the signals from the intake measuring element 9 are used to produce the evaluation of a spectrogram corresponding to the incoming fibre material 5 and to adjust the drawing system 2 automatically.

In the embodiment according to Figs. 8 to 10, as adjusting elements there are shown displacing elements 36, 57 and 37, 58 for adjusting the nip line spacings. By way of the machine control and regulating device 56, the evaluation results can be used also to adjust the regulating motor 19 and/or the main motor 20 (Fig. 1) and

thus to alter the draft. By way of the machine control and regulating device 56, the evaluations can also effect both operations, that is to say the change in the nip line spacings of the drawing system 2 and the change in the drafts.

A plurality of regulated draw frames 1a to 1e can be connected to the computer unit 26. According to Fig. 1, a central computer unit 26 can be present, which produces and evaluates the spectrograms and also carries out the control and regulating tasks in the regulated draw frames 1a to 1e. The production and evaluation of the spectrograms can also be carried out in the computer 26, each regulated draw frame 1a to 1e having its own control and regulating device 56, as shown in Figures 8 to 10.

The invention has been explained using the example of a regulated 1 draw frame. It can also be used in machines that have a regulatable drawing system 2, for example a carding machine 32, combing machine or the like. It can also be used in a carding machine 32 in which fibre material is drafted on the clothed rollers in the direction of operation.

The term "fibre structure" is used herein in relation to fibre material that is passed through a drawing system to refer to any collection of fibres that is capable of being fed through the drawing system in question and, for example, may refer to <u>inter alia</u> a single sliver, a fibre sliver combination or a fibre web.

Claims

1. A method of regulating a drawing system having at least one drafting zone, comprising ascertaining at a measuring location in the drawing system a variable relating to at least one travelling fibre structure, generating therefrom a spectrogram of said at least one fibre structure evaluating the spectrogram and adjusting the drawing system in dependence on that evaluation.

2. A method according to claim 1, in which the fibre structure, the spectrogram of which is used, is the drawn fibre sliver.

3. A method according to claim 1 or claim 2, in which the fibre structure, the spectrogram of which is evaluated, is the feed fibre material.

4. A method according to any one of claims 1 to 3, in which the shape of the spectrogram is evaluated.

5. A method according to any one of claims 1 to 4, in which the content of the spectrogram is evaluated.

6. A method according to any one of claims 1 to 5, in which the evaluation includes a weighting.

7. A method according to any one of claims 1 to 6, in which the basic form curve (envelope curve) of the spectrogram is evaluated.

8. A method according to claim 7, in which there are determined the area below the basic form curve; a rectangular region, the area of which is the same as the area of the basic form curve; the area of the basic form region that projects beyond the rectangular region; and the position of the centre of gravity of the projecting basic form region.

9. A method according to claim 7 or claim 8, n which the individual forms projecting beyond the basic form curve are evaluated.

10. A method according to any one of claims 7 to 9, in which instances where the limit value is exceeded in the spectrogram are evaluated.

11. A method according to any one of claims 7 to 10, in which envelope curves are determined for the individual forms projecting beyond the basic form curve.

12. A method according to claim 11, in which for each envelope curve there are determined the distance between the upper stationary point and the basic form curve, the area below each envelope curve and the position of the centre of gravity of the area below each envelope curve.

13. A method according to claim 12, in which the size of the region, the projecting basic form region, the distance and/or the areas are used to adapt the drawing system.

14. A method according to any one of claims 1 to 13, in which an evaluation is carried out for shape and content by zones.

15. A method according to any one of claims 1 to 14, in which an evaluation of part areas and/or part forms is carried out.

16. A method according to claim 15, in which an evaluation of the position of the part areas and part forms is carried out.

17. A method according to claim 15 or claim 16, in which an evaluation of the positions of the centre of gravity of the part areas and part forms is carried out.

18. A method of regulating a drafting system, substantially as described herein with reference to any of Figs. 1 to 5.

19. A regulated drawing system for fibre material having at least one drafting zone, and at least one sensor for ascertaining at a measuring location a variable relating to at least one travelling fibre structure, the regulated drawing system comprising means for generation of a spectrogram of at least one fibre structure, the shape (form, content) of which spectrogram can be evaluated, and means for adjusting the drawing system in dependence on the results obtained in said evaluation.

20. A regulated drawing system according to claim 19, in which to adjust the drawing system the nip line spacings of the roller pairs that delimit the drafting zones are adjustable.

21. A regulated drawing system according claims 19 or claim 20, in which the arrangement is such that the drawing system can be adapted when a switch is made to a new material.

22. A regulated drawing system according to any one of claims 19 to 21, in which the degrees of drafting of the drafting zones of the drawing system are adjustable.

23. A regulated drawing system according to any one of claims 19 to 22, in which the total degree of drafting is adjustable.

24. A regulated drawing system according to any one of claims 19 to 23, in which, for example, after each change of material, optimum nip line spacings can be set automatically.

25. A regulated drawing system according to any one of claims 19 to 24, in which a computer, for example a microcomputer and microprocessor, is present, which is used to evaluate the spectrogram and to adjust the drawing system.

26. A regulated drawing system according to any one of claims 19 to 25, in which the arrangement is such that the fibre mass can be detected on-line at the measuring point.

27. A regulated drawing system according to any one of claims 19 to 26, in which on-line spectrogram determination is carried out.

28. A regulated drawing system according to any one of claims 19 to 27, in which the spectrogram is reproduced on a display, for example a screen or print-out.

29. A regulated drawing system according to any one of claims 1 to 28, in which an on-line spectral analysis is carried out.

30. A regulated drawing system according to any one of claims 19 to 29, in which the regulated drawing system is arranged downstream of at least one upstream drawing system.

31. A regulated drawing system for fibre material having at least one drafting zone, a controllable or regulatable drive system for determining the degree of drafting in the said drafting zone, a programmable control system for the drive system and at least one sensor for ascertaining at a measuring point the fibre mass per unit of length passing through, in which system a draft-determining signal is stored in a memory of the control system over a predetermined period and information for adjusting the drawing system is obtained from the stored values, characterised in that the information includes a spectrogram of at least one fibre structure the shape (form, content) of which spectrogram is evaluated and used to adapt the drawing system.

32. A regulated drawing system substantially as described herein with reference to and as illustrated by any of Figs. 1 to 10.

33. A draw frame comprising a regulated drawing system according to any one of claims 19 to 32.

34. A draw frame according to claim 33, in which the arrangement is such that the spectrogram can be generated from measurements of at least one fibre structure upstream of a main drafting zone of the draw frame.

35. A draw frame according to claim 34, in which the arrangement is such that the spectrogram can be generated from measurements of at least one fibre structure downstream of a main drafting zone of the draw frame.

36. A carding machine comprising a regulated drawing system according to any one of claims 19 to 35, in which the regulated drawing system is associated with the outlet of a carding machine.

37. A carding machine according to claim 36, in which the regulated drawing system is arranged between the sliver funnel of the carding machine and the rotating head of the can coiler.

38. A carding machine according to claim 36 or claim 37, in which the fibre structure in a carding machine is a feed sliver.

39. A draw frame or a carding machine according to any one of claims 33 to 38, in which the fibre structure is drawn sliver.

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Claims searched:	1-39	**Date of search:**	16 September 1998

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): D1D, G3R.

Int Cl (Ed.6): D01H.

Other: Online : WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1413823	(IND. NUCLEONICS) see analyses of measured, stored, data, e.g. distribution curves, Fig. 3.	1, 19, 31.
X	US 5394591	(JORNOT) see use of mean value of measured data, e.g. Col. 11, l. 24 on.	1, 19, 31.
X	US 5010494	(LORD) see e.g. use of histograph, Col. 8, l. 60 on.	1, 19, 31.
X	US 4199844	(GOETZINGER) see use of average of stored measurements during drafting startup.	1, 19, 31.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.